Package 'ifaTools'

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Title Toolkit for Item Factor Analysis with 'OpenMx'

Version 0.23

Description Tools, tutorials, and demos of Item Factor Analysis using 'OpenMx'.
This software is described in Pritikin & Falk (2020) <doi:10.1177/0146621620929431>.

License AGPL (>= 3)

VignetteBuilder knitr

Imports methods

Suggests testthat, roxygen2, knitr (>= 1.8), gridExtra, plyr, xtable

Depends shiny (>= 0.10), ggplot2, reshape2, rpf (>= 0.48), OpenMx (>= 2.3.1), R (>= 2.14.0)

URL https://github.com/jpritikin/ifaTools

RoxygenNote 7.1.1

NeedsCompilation no

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R topics documented:

`addExploratoryFactors` *Adds exploratory factors to a single factor model*

Description

Adds exploratory factors to a single factor model

Usage

```
addExploratoryFactors(model, toAdd, ..., addUniquenessPrior = TRUE)
```

Arguments

`model`	a single factor (possibly multigroup) model
`toAdd`	the number of factors to add
`...`	Not used. Forces remaining arguments to be specified by name.
`addUniquenessPrior`	whether to add a uniqueness prior to the model (default TRUE)

`iccPlot` *Plot expected and observed table from SitemFit*

Description

WARNING: This function is under development. The API may change in a future release.

Usage

```
iccPlot(grp, itemName, ..., width = 3, dataBins = 11, basis = c(1), factor = 1)
```

Arguments

`grp`	an IFA group
`itemName`	name of item to plot
`...`	Not used. Forces remaining arguments to be specified by name.
`width`	sets the x axis to [-width,width]
`dataBins`	number of partitions for the latent scores
`basis`	the basis vector in the latent space
`factor`	the score to use (TODO: should be a function of the basis vector?)

itemModelExplorer *A Shiny app to experiment with item models*

Description

A Shiny app to experiment with item models

Usage

```
itemModelExplorer()
```

Examples

```
## Not run:
itemModelExplorer()  # will launch a browser in RStudio

## End(Not run)
```

itemResponseMap *Create item response map table*

Description

Categories are placed at the mean score of the examinees who picked that category.

Usage

```
itemResponseMap(grp, ..., factor = 1)
```

Arguments

grp	an IFA group
...	Not used. Forces remaining arguments to be specified by name.
factor	which factor to plot (defaults to 1)

Value

A data.frame of the raw data backing the plot. Item outcomes without any observations are omitted.

modelBuilder *A Shiny app for building IFA models*

Description

A Shiny app for building IFA models

Usage

```
modelBuilder()
```

Examples

```
## Not run:
modelBuilder()  # will launch a browser in RStudio

## End(Not run)
```

plotInformation *Plot item information in the latent distribution*

Description

For multidimensional items, you will need to supply a basis vector. This vector is normalized to unit length.

Usage

```
plotInformation(grp, ..., width = 3, showTotal = FALSE, basis = c(1))
```

Arguments

grp	an IFA group
...	Not used. Forces remaining arguments to be specified by name.
width	the plot will span from -width to width
showTotal	whether to plot the total item information
basis	the basis vector (for multidimensional items)

replicateModelBy *Replicate a model for each group of data*

Description

The reference group is fixed to a zero mean and identity covariance matrix.

Usage

```
replicateModelBy(
  tmpl,
  fullData,
  mMat,
  covMat,
  ...,
  splitCol = "population",
  refGroup = "general",
  split = TRUE,
  compressData = TRUE
)
```

Arguments

tmpl	an OpenMx model
fullData	the complete data including the column indicating group membership
mMat	an MxMatrix for latent means
covMat	an MxMatrix for latent covariance
...	Not used. Forces remaining arguments to be specified by name.
splitCol	the name of the column used to indicate group membership
refGroup	the name of the reference group
split	whether to split the data (defaults to TRUE)
compressData	whether to apply compressDataFrame (defaults to TRUE)

SitemPlot *Plot expected and observed table from SitemFit*

Description

Plot expected and observed table from SitemFit

Usage

```
SitemPlot(sout, itemName, ..., showSampleSize = TRUE)
```

Arguments

sout	output from SitemFit
itemName	name of item to plot
...	Not used. Forces remaining arguments to be specified by name.
showSampleSize	whether to show the sample size at the top of the plot

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uniquenessPrior *Uniqueness prior to assist in item factor analysis*

Description

To prevent Heywood cases, Bock, Gibbons, & Muraki (1988) suggested a beta prior on the uniqueness (Equations 43-46). The analytic gradient and Hessian are included for quick optimization using Newton-Raphson.

Usage

```
uniquenessPrior(model, numFactors, strength = 0.1, name = "uniquenessPrior")
```

Arguments

model	an mxModel
numFactors	the number of factors. All items are assumed to have the same number of factors.
strength	the strength of the prior
name	the name of the mxModel that is returned

Details

To reproduce these derivatives in maxima for the case of 2 slopes (c and d), use the following code:

```
f(c,d) := -p*log(1-(c^2 / (c^2+d^2+1) + (d^2 / (c^2+d^2+1))));
diff(f(c,d), d),radcan;
diff(diff(f(c,d), d),d),radcan;
```

The general pattern is given in Bock, Gibbons, & Muraki.

Value

an mxModel that evaluates to the prior density in deviance units

References

Bock, R. D., Gibbons, R., & Muraki, E. (1988). Full-information item factor analysis. *Applied Psychological Measurement, 12*(3), 261-280.

Examples

```
numItems <- 6
spec <- list()
spec[1:numItems] <- list(rpf.drm(factors=2))
names(spec) <- paste0("i", 1:numItems)
item <- mxMatrix(name="item", free=TRUE,
                 values=mxSimplify2Array(lapply(spec, rpf.rparam)))
item$labels[1:2,] <- paste0('p',1:(numItems * 2))
data <- rpf.sample(100, spec, item$values)  # use a larger sample size
m1 <- mxModel(model="m1", item,
              mxData(observed=data, type="raw"),
              mxExpectationBA81(spec),
              mxFitFunctionML())
up <- uniquenessPrior(m1, 2)
container <- mxModel("container", m1, up,
                     mxFitFunctionMultigroup(c("m1", "uniquenessPrior")),
                     mxComputeSequence(list(
                       mxComputeOnce('fitfunction', c('fit','gradient')),
                       mxComputeReportDeriv())))
container <- mxRun(container)
container$output$fit
container$output$gradient
```

`univariatePrior` *Univariate priors commonly used in IFA models*

Description

The returned model evaluates to the fit of the priors in deviance (-2 log likelihood) units. The analytic gradient and Hessian are included for quick optimization using Newton-Raphson.

Usage

```
univariatePrior(type, labels, mode, strength = NULL, name = "univariatePrior")
```

Arguments

`type`	one of c("lnorm","beta","logit-norm")
`labels`	a vector of parameters to which to apply the prior density
`mode`	the mode of the prior density
`strength`	a prior-specific strength (optional)
`name`	the name of the mxModel returned

Details

Priors of type 'beta' and 'logit-norm' are commonly used for the lower asymptote parameter of the 3PL model. Both of these priors assume that the parameter is in logit units. The 'lnorm' prior can be used for slope parameters.

Value

an mxModel that evaluates to the prior density in deviance units

Examples

```
model <- univariatePrior("logit-norm", "x1", -1)
model$priorParam$values[1,1] <- -.6
model <- mxRun(model)
model$output$fit
model$output$gradient
model$output$hessian
```

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